

## PATENT SPECIFICATION



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## COMPLETE SPECIFICATION.

## Condenser for Refrigerating Machines.

I, WILLIAM HOGAN LEWERS, Registered Patent Agent, of 47, Victoria Street, Westminster, London, S.W. 1, a British Subject, do hereby declare the nature of this invention (communicated to me by A. Borsig, Gesellschaft mit beschränkter Haftung, a German Company, of 19/37, Berliner Strasse, Berlin-Tegel, Germany), and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

Condensers with horizontal cooling tubes for refrigerating machines are known in which the working fluid surrounds the tubes and the cooling water flows through the tubes from one water vessel to another, which are provided respectively with an inlet and an outlet for the cooling water. Since several tubes in parallel are in action simultaneously, the velocity of the cooling water is small and the heat transmitted is of small amount. Besides, a separate oil-separator is required, as without it the outsides of the tubes would soon become dirty. Sprinkler condensers are also known, with vertical collecting vessels or headers and horizontal or approximately horizontal cooling tubes, which working fluid flows.

With these arrangements a good separation of the non-condensable constituent of the gas is not attainable, since the liquid condensed on the cooling tubes remains clinging to the cooling surface and does not leave it quickly enough.

Further, a condenser is known, which has only one collecting vessel. In this collecting vessel, however, gas and liquid are in violent movement, so that oil cannot be deposited. Besides with this arrangement a deposition of oil is only possible when the liquid is throttled, whereby portions of the cooling surface are deprived of their effectiveness.

According to the present invention, the defects of the aforementioned arrangements are eliminated, by arranging that the collecting vessels or headers of the condenser, into which gaseous working fluid enters are connected by cooling tubes cooled by an evaporating water spray the walls of which at the lower sides of the

tubes incline downwardly in the direction of the flow through the tubes, i.e. from the inlet ends of the tubes towards their outlet ends, and by a collecting pipe at the deepest position. In one embodiment of the invention the cooling tubes increase in diameter from their inlet end to their outlet end, whereby the desired inclination of the lower portions of their walls may be obtained whilst arranging the tubes with their longitudinal axes horizontal. For the effective removal of air, the headers are connected, at least at the highest point thereof and immediately above the liquid level, to an air exhausting device well known in itself.

The invention is diagrammatically illustrated in the appended drawing, in one form by way of example.

In this drawing, 1, 2 and 3 denote cooling tubes, 4 and 5 collecting vessels or headers, 6 the inlet and 7 the outlet for the working fluid, 8 and 9 baffle plates, 10 a collecting pipe, 11 an oil outlet, 12 air exhaust pipes 13, an air exhauster, and 14 a water sprinkler device.

The horizontal tubes 1 debouch at one side into a header 4 and at the other side into a header 5. The gaseous working fluid flows in at the inlet 6, while the liquefied working fluid flows down through the outlet 7. The cross sections of the headers 4 and 5 are made large enough to ensure that gas or liquid may come to rest and that oil particles may be deposited therefrom. Baffle plates 8 and 9 may be placed close to the inlet 6 and outlet 7. The pipe 10 connects the two headers 4 and 5 at their lowest positions or nearly so, and from it the deposited oil is removed through the outlet 11, and in some cases led back again to the apparatus. From the one collecting space the oil is thrown down mainly in the form of drops into the pipe 10, from the other collecting space mainly in liquid form with the liquefied working fluid. The deposited oil from both said collecting spaces unites in the pipe 10, from which it is removed direct, to be again used in the apparatus if desired. The two collecting vessels 4 and 5 extend to sufficient depth below the lowest cooling tubes to avoid the flow of

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gas through the collecting pipe 10. The outlet 7 is connected to the collecting vessel 5 at a point high enough to guard against oil being carried with the liquid working fluid flowing out therethrough. The highest cooling tubes are purposely arranged at the highest possible positions of both vessels 4 and 5, in order to avoid the collection of air at either side. Shifting pipes 12 connected to the collecting vessel 5 at different heights serve for the removal of air, said pipes 12 discharge into an air exhauster 13, in which in well known manner any working fluid is thrown down by cooling, while the air escapes into the atmosphere. From the water sprinkler device 14 the cooling water is distributed over the cooling tubes and also over the collecting vessels. The tube 2 is shown by way of example as of gradually increasing diameter, the tube 3 as sufficiently inclined in the direction of flow, that the liquid level 15 lies at or near the horizontal.

By the gradual increase of diameter of the cooling tubes in the direction of flow of the working fluid, the condensed liquid whose quantity increases along the direction of flow has a level which is either horizontal or inclined downwards in the direction of flow, but is not inclined downwards and backwards opposite to the direction of flow, as is the case with horizontal cylindrical tubes. This effect of the tubes with expanding bore is also given by cylindrical tubes inclined slightly downwards in the direction of flow.

If desired, the collecting tube 10 may incline downwardly from its ends towards the outlet 11.

It is to be noted that no claim is herein made to the arrangement of sloping

tubes in tubular surface and evaporative condensers, such sloping tube arrangement per se being known.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A condenser for refrigerating machines having vertically disposed headers or collecting vessels and horizontal, or substantially horizontal cooling tubes, cooled by an evaporating water spray, characterized in that the walls of the cooling tubes at the lower sides of the tubes incline downwardly from the inlet ends of the tubes towards the outlet ends thereof, and at their lowermost parts the headers are connected by a liquid collecting pipe.

2. A condenser for refrigerating machines having upright collecting vessels and cooling tubes arranged with their axes horizontal and cooled by an evaporating water spray, characterized in that the collecting vessels are connected by cooling tubes which increase in diameter in the direction of flow of the working fluid, the bottoms of the vessels being connected by a collecting pipe.

3. A condenser as claimed in claim 1, or in claim 2, characterized in that the collecting vessels are connected, at least at the highest point thereof and immediately above the liquid level, to an air exhausting device.

4. A condenser for refrigerating machines substantially as described with reference to the accompanying drawing.

Dated this 27th day of February, 1931.

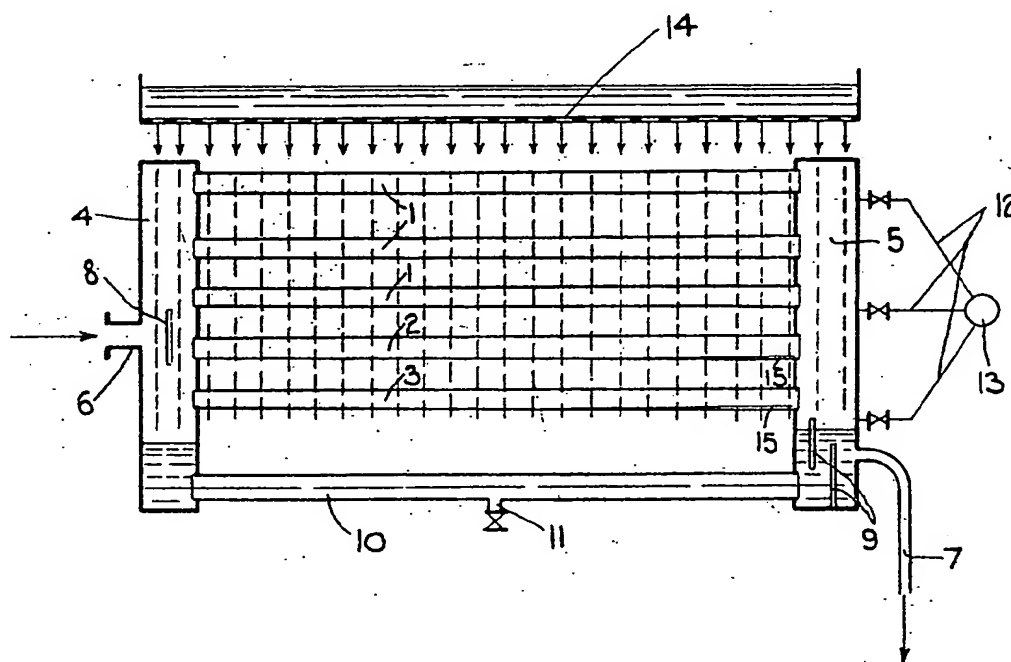
JOHN P. O'DONNELL & Co.,

Agents for Applicant,

47, Victoria Street, Westminster, S.W. 1.

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*[This Drawing is a reproduction of the Original on a reduced scale.]*



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